North Dakota Space Grant Consortium
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowship and scholarship programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The North Dakota Space Grant Consortium is a Capability Enhancement Consortium funded at a level of $590,066 for fiscal year 2010.

PROGRAM GOALS

North Dakota Space Grant stated the following SMART goals in its FY 2010 proposal and budget:

1. Fund six Summer Faculty Fellowships that will allow college faculty to revise or create a NASA-/STEM-relevant college course to be taught in a North Dakota institution of higher education.
2. Fund three M.S. students in the University of North Dakota (UND) Department of Space Studies to conduct M.S. thesis research that is NASA-/STEM-relevant. Provide a tuition waiver for one student in the same department.

3. Fund two NASA-relevant Research Focus Area (RFA) research projects that will promote the development of independently-funded NASA research clusters in North Dakota.
4. Provide funding of $10,000 for students from North Dakota colleges and universities to attend national, hands-on, NASA-relevant workshops such as RockOn, RockSat, BalloonSat and the High Altitude Student Payload (HASP) programs.
5. Fund at least five students to intern at a NASA field center.
6. Conduct the Teacher Space Education Initiative (TSEI) workshop and teach at least 50 teachers fundamental space knowledge that will be useful in their K-12 classrooms.
7. Fund at least 15 K-12 teachers to participate in the Spaceward Bound workshop.

8. Fund up to six North Dakota FIRST Robotics teams to participate in regional and national team competitions.
9. Provide funding to the North Dakota Heritage Center to develop and build two educational, NASA-relevant trunks that can be used in K-8 classrooms across North Dakota.
10. Provide funding for the Space Grant Internet Telescope Network, or UND Observatory, to become fully operational in 2010.

Following is the percentage of students who have taken their "next step" and have been successfully tracked through their next step in relation to the last year of Space Grant support:

100% for 2006
100% for 2007
100% for 2008
100% for 2009
n/a for 2010—2010 data just inputted into the tracking system

PROGRAM/PROJECT BENEFITS TO OUTCOME (1, 2, OR 3)

Students who received summer internships in 2010 were included in our previous year end report. Students who will receive summer internships in 2011 will be included in next year's report. (This is because this report covers the time period of August 1, 2010 to March 31, 2011.)

For fall semester 2010 and spring semester 2011, Space Grant provided a total of 18 research fellowships and 85 scholarships in North Dakota.

> *"It allowed me to gain experience doing research in a field that I enjoy. The program also provided me with the opportunity to expand my education beyond the classroom and work alongside classmates and professors doing high altitude balloon research. (Submitted by John Boucha, research fellowship recipient in 2009 and 2010.)*

Additional funding for scholarships was provided to the five tribal colleges in the state. That additional funding was to support five special American Indian Scholarships of $2,500 for exceptional students who plan to transfer to a four year college after receiving their associate degree at their respective tribal colleges.

The Gateway to Science Center and the North Dakota State Historical Society were recently added as Space Grant affiliates. Planning has begun for Space Grant to be involved in helping to develop displays for the new "Modern Era" gallery at the Heritage Center; Space Grant is teaming with the Gateway to Science Center to present a teacher training workshop in June of 2011.

PROGRAM ACCOMPLISHMENTS

Outcome 1 programs

Undergraduate scholarships/fellowships. The NDSGC provided 85 undergraduate students with scholarships at its affiliate institutions where 43 awardees were female and 42 awardees were male. Eight of these students were American Indians. The low number of American Indians is explained by the fact that four of the tribal colleges have not yet submitted the names of their scholarship recipients for this academic year. And no tribal college has yet submitted the name of the recipient of its special American Indian Scholarship. We anticipate that we will receive the list of scholarship recipients from the tribal colleges by the end of May 2011 and those numbers will then be included in next year's report.

In addition, 18 research fellowships were also provided, of which 16 were male, two were female. One was an American Indian male. Fifteen of the awards were for $2,500 or more and thus were "significant;" seven went to undergraduate students and 11 went to graduate students. Awards of less than "significant" were given to students who had partial funding to do research; additional funding from Space Grant made it possible for them to complete their research projects.

Research Focus Area (RFA) research. Dr. Eric Brevik, Dickinson State University, received funding for the first RFA project in North Dakota, titled, "Undergraduate research collaboration with NASA Goddard Space Flight Center." This project, which involved a female undergraduate student from DSU, has the goal of using Landsat data to detect cover crops in North Dakota. Dr. Brevik and the student worked with a NASA Goddard collaborator, Eric Brown de Colstoun, at Goddard to develop an implementation plan for the project. This was the first RFA-funded project and is an important step forward in developing NASA research in North Dakota.

John Nordlie, Research Associate, UND, received funding for RFA project entitled "UAS based remote sensing for precision agriculture." This project involves working with farmers in the region to detect changes in the agricultural fields due to damage caused by insect, fungus, water, hail, wind, etc. The project is expected to lead to operationalization of the use of small, easy to use, unmanned aerial systems by farmers so that they can collect their own remote sensing data as and when needed, without having to depend on the satellite data providers. Essentially this project aims to put the power of collecting remote sensing information in the hands of farms themselves. Several experimental flights using "CropCam" an unmanned aircraft is planned for the summer of 2011.

Dr. Ghodrat Karami of North Dakota State University received RFA funding to continue the design of a Human Powered Vehicle (HPV). The groups of students at NDSU Mechanical Engineering have conducted conceptual design, implemented their design in drawings, selected materials and have manufactured and assembled the vehicle so far. They have to examine and challenge the vehicle under loading and in practice. The next stage of the job is the optimization and collecting the data in practice on the vehicle in order to be able to compete in the competition. The group has made plans to attend the 2011 HPV Competition sponsored by ASME to be held in April 29 - May 1, 2011 in Indianapolis Motor Speedway, Indianapolis, IN.

Dr. Kerry Hartman of the Fort Berthold Community College, an institution tribally charted by the Three Affiliated Tribes of the Mandan, Hidasta and Arikara Nations, received RFA funding for the project "Utilizing Remote Sensing to Investigate the Surface Impacts of Oil Development on the Fort Berthold Indian Reservation." The project which involves students from the college and USGS scientists from EROS Data Center, aims to create a baseline database of information regarding the environmental impacts of surface activities of oil development on the Fort Berthold Indian Reservation.

Dr. Xiquan Dong, Professor, and Tim Logan, graduate student, UND, received funding for RFA project entitled "Investigation of the physical and chemical properties of Asian Dust and Pollution using NASA surface-satellite and DOE ARM Mobile Facility Observations in China." The research investigates the properties of Asian dust/pollution within the Asian continent.

UND Observatory/Space Grant Internet Telescope Network (SGITN). Activities in 2010-11 included the last major infrastructure improvement – installation of a modern office trailer – as well as operations in support of research projects by two UND Space Studies M.S. students. Internet Observatory #1 and #2 operated for a combined total of 33 nights from August – November 2010 in support of asteroid and eclipsing binary star research projects. One undergraduate physics student and two M.S. students assisted one faculty member in maintenance and operation of the observatory. The Badlands Observatory in South Dakota was also used in support of one UND Space Studies M.S. student.

An NSF Research Experiences for Undergraduates (REU) proposal was submitted to establish the UND Observatory as an REU Site, but the proposal was not funded.

Summer Faculty Fellowships. Applications are now being accepted for Faculty Summer Fellowships for 2011. Those recipients and their courses will be tallied in next year's final report.

National Space Grant Workshops. This year also saw five faculty and six students (four undergraduate, two graduate) build a multi-gas sensor payload for a zero-pressure balloon that was to be launched in September 2010 as part of the High Altitude Student Payload (HASP) project. The launch has been delayed until later this summer. The North Dakota High Altitude Balloon (HAB) program was also active in FY 2010 with a balloon launch in November 2010 that carried a tracking system as a primary payload and a biological experiment as a secondary payload. HAB program participants included three faculty, five graduate students, and one undergraduate student. A developing balloon program in the state called Near Space Recovery Technology currently involves four faculty and five undergraduate students. These programs are under the direction of Dr. Ron Fevig at UND; he has been most successful in involving students and faculty from Space Studies, Mechanical Engineering and Electrical Engineering.

Graduate Research Assistantship/Tuition Waivers. Space Grant funded Eric O'Dea, an M.S. student in Department of Space Studies. O'Dea is responsible for assisting with the operations and maintenance of the UND Observatory under the guidance of Dr. Paul Hardersen. O'Dea is also pursuing an M.S. thesis and is conducting a study of two S-type asteroids in the main asteroid belt. Another funded student is Nicole Thom of Space Studies who is working with Dr.

James Casler investigating the production of oxygen from the lunar surface using hydrogen reduction of ilmenite. Jeremy Smith is also funded by Space Grant. He is working with Dr. Santhosh Seelan using remote sensing technology on UAVs to provide timely data on field crops for farmers.

Three students took the "next step" in FY10: one accepted a STEM position in industry; one accepted a STEM position in academia; and one went on to a position in a non-STEM discipline.

Outcome 2 programs

NASA center internships. The NASA Space Centers are currently reviewing applications for internships for the summer 2011. Thus far, Space Grant in North Dakota has agreed to support three students for summer internships. Those recipients will be recorded in next year's report.

FIRST Robotics. Three teams from North Dakota high schools were supported for regional competitions in the FIRST Robotics program in FY 2010. Of particular note is the team from Northwood-Hatton High Schools, which did advance to the national competition during this year (as they did last year). Space Grant provided additional funding for that team so that they were able to attend the national competition in St. Louis.

The TSEI workshops for K-12 teachers were not held the past year. But instead, plans are to conduct two grade 6-12 educator workshops in June of 2011 which will be taught by a professional middle school educator from New Hampshire.

Space Grant conducted pre-service workshops for 148 soon-to-be student teachers at the University of North Dakota, North Dakota State University, Mayville State University and Valley City State University.

Spaceward Bound was provided funding by the North Dakota Department of Public Instruction and so no funds were needed from Space Grant in the past year.

Outcome 3 programs

Heritage Center. A project with the North Dakota Heritage Center was begun to develop two educational trunks that will be available for K-8 classrooms across North Dakota. The themes for the trunks center on aurorae, meteorites, and other direct connections between North Dakota and NASA. The trunks will be stocked with objects that can be handled by students, such as meteorite samples, space suit materials, and other tactile objects. This project has expanded to include permanent space themed displays that can be taken to conferences, shopping centers, etc. The Heritage Center has become a very active affiliate of Space Grant. We will now work with it to develop permanent displays (replicas of Explorer I or the NDX-1 space suit) for the "Modern Era" gallery in the new addition to the museum.

Gateway to Science Center will collaborate with us to provide a 6-12 teacher workshop this summer. Space Grant continues to "brain storm" with the Gateway staff to plan joint ventures in the future.

NASA 2010 Education Priorities:

College students in North Dakota were involved in "hands on experiences in science and engineering" through the NDX-2 space suit project, HASP, BalloonSat, Human Powered Vehicle, Lunabotics, remote sensing using UAVs, asteroid research, etc.

Space Grant has attempted to strengthen its relationships with the two year community colleges and tribal colleges by site visits and continued communication with the respective affiliate contacts at those institutions.

Space Grant is pleased that all five tribal colleges in the state are affiliate partners of Space Grant. Each tribal college participates at an activity level at which it feels comfortable.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PART MEASURES:

Student Data and Longitudinal Tracking: Total awards=137; Fellowships/Scholarship=103; Higher Education/Research Infrastructure=34; 9 of the total awards represent underrepresented minority F/S funding. During the FY10 program year 1 accepted a STEM position in industry, 1 accepted a STEM position in academia and 1 went on to a position in a non-STEM discipline.

For all students that were significantly supported in the period spanning FY06-FY10, 4 are pursing advanced degrees in STEM disciplines, 1 accepted a STEM position at a NASA contractor, 9 accepted STEM positions in industry, 1 accepted a STEM position in K-12 academia, 5 accepted STEM positions in academia and 1 went on to a position in a non-STEM discipline. The remaining students have not yet received the degree that they are pursing while they received their Space Grant award.

"The grant allowed me to focus on the research that I wanted to perform. In addition I have used my unmanned aircraft flight skills that the grant aided in developing to be a part of a team that took first place in the UAV Outback Challenge held in Australia this year."(Submitted by David Dvorak, research fellowship recipient in 2007.) Since Dvorak wrote that, the North Dakota Agricultural Products Utilization Board awarded him a $25,000 grant to start a private company called "Field of View" which will use UAVs to provide remote sensing data on farmers' fields. Dvorak is not only a successful academic and researcher but a promising young businessman in North Dakota.

"I am continually looking and researching methods that I can use in order to provide guidance to Native American students in STEM related education. I intend to find or use methods of delivery to indigenous students that may lead them to education in STEM disciplines that may one day lead them to achieving goals in STEM careers. (Submitted by Lane Azure, research fellowship recipient in 2009.)

"It helped further my senior thesis research. This allowed me to produce a more in-depth study of precipitation in the Arctic. It also furthered my interest in atmospheric research and helped me continue on to graduate school." (Submitted by Andrea Newmann, research fellowship recipient in 2009.)

Course Development:

Faculty who received Summer Faculty Fellowships in 2010 to develop or revise STEM college courses were included in our previous year end report (2009). Faculty who will receive fellowships in 2011 will be included in next year's report. (This is because this report covers the time period of August 1, 2010 to March 31, 2011.)

Matching Funds:

The North Dakota Space Grant Consortium was provided with $599,066 from NASA. The North Dakota Legislature provided $171,620 cash match and the University of North Dakota (the lead institution) provided $247,446 in match.

Minority Serving Institutions Collaborations:

Five tribal colleges in North Dakota are affiliates of the North Dakota Space Grant Consortium. They participate in our scholarship program and are regular attendees at our annual meeting when we set priorities for the coming year. In addition, a faculty member at Fort Berthold Community College was a recipient of funding for a Focused Research Area from Space Grant. His research topic is: *Utilizing Remote Sensing to Investigate the Surface Impacts of Oil Development on the Fort Berthold Indian Reservation*. Space Grant also worked with the Regional Educator Resource Center at UND and with Sitting Bull Community College to provide a variety of NASA space science materials and educators guides for the 2010 Professional Development Day for Standing Rock (Reservation) Educators. Approximately 400 K-12 teachers from 15 different tribal schools on that reservation participated in the conference.

IMPROVEMENTS MADE IN THE PAST YEAR:

The transition from one director to another went smoothly. The new director and the deputy director immediately began visiting affiliate campuses. Dr. Seelan developed a new e-mail list for communicating with the affiliate campuses. No longer will e-mails go to only the "official affiliate contacts" but to all faculty and staff at each college that has expressed interest in Space Grant.

Improved publicity for the FRAs resulted in a larger pool of applications and thus the number of proposals funded was increased.

Emphasis was put on funding research projects beyond the UND Observatory and the Human Spaceflight Laboratory. Both the latter have been very successful and so now efforts will increase to enhance, for example, the development of ballooning technologies and the subsequent research projects.

Space Grant will continue to encourage students from the non-research colleges to apply for research fellowships. This year one such fellowship was given to a student at Lake Region State College, a two year community college. We are in the process of discussing "mini research

fellowships" with our affiliate contacts as a means of getting students interested in research so that when they transfer to a university they will apply for a "full" research fellowship.

Space Grant in North Dakota is working to see to it that more and more funding is available for the tribal colleges, the two year colleges and the four year non-research colleges to participate in the Focused Research Areas. The definitions of the four categories have been expanded (for example, "Planetary Space Suit Development" has become "Human Spaceflight") so that more faculty and students at the non-research colleges can be involved. Space Grant fully expects that in the years ahead the categories for the Focused Research Areas will be increased in number.

Space Grant visited half our affiliate campuses the past year. We planned to visit the remaining half during second semester 2011. Each visit we planned in 2011 had to be canceled due to bad weather and roads. Visits to our affiliate campuses has been suspended until June when we are certain that we will not encounter sleet, snow or zero visibility due to storms.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION:

The Space Grant affiliate members in North Dakota helped develop our strategic plan. Throughout the academic year, affiliate members provide input as to what degree of involvement the respective colleges and universities will have in various projects. An annual meeting of all affiliate representatives is held each spring; at that time discussion is held as to possible new projects and programs that could be sponsored by Space Grant.

Institutions that comprise the North Dakota Space Grant Consortium include the following:

Bismarck State College—two year community college
Cankdeska Cikana Community College—tribal college at Spirit Lake Indian Reservation
Dakota College at Bottineau—two year community college
Dickinson State University—public four year college
Fort Berthold Community College—tribal college at Fort Berthold Indian Reservation
Gateway to Science Center—children's science museum in Bismarck
Grand Forks Herald—regional, daily newspaper
Lake Region State College—two year community college
Mayville State University—public four year college
Minot State University—public four year college
North Dakota Heritage Center—state history museum in Bismarck
North Dakota State College of Science—two year technical college in Wahpeton
North Dakota State University—doctoral research university in Fargo
Sitting Bull College—tribal college at Standing Rock Indian Reservation
Turtle Mountain Community College—tribal college at Turtle Mountain Indian Reservation
United Tribes Technical College—tribal college in Bismarck not affiliated with a specific Indian Reservation
University of North Dakota—doctoral research institution in Grand Forks
Valley City State University—public four year college
Williston State College—two year community college